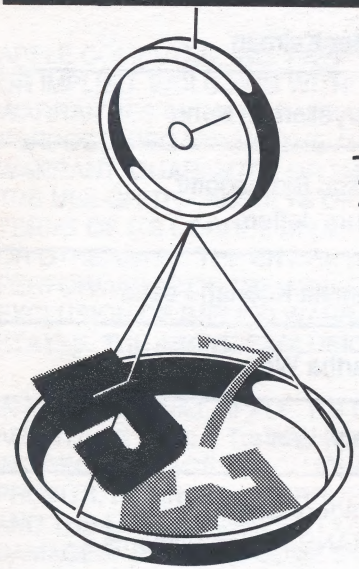
MATH SHOP®



Ten Challenging Simulations That Help Students Apply Essential Math Skills

By Cary Hammer

SCHOLASTIC

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INTRODUCTION

The shops in the *Math Shop* mall are at a stand still. The store-keepers aren't able to provide good service for their customers. The druggist at the pharmacy is having trouble making each prescription just right, and the baker needs help dividing up donut orders. In fact, all the store owners are in need of a math-minded assistant like you! Put your arithmetic skills to work as you solve some very interesting problems, and lend a hand to help keep the *Math Shop* mall in business.

Where does the work begin? You can start by packing bags at the grocery store, or ring up sales in the boutique. Perhaps you'd rather deal with eggs at the dairy. It's your choice. When you've had some experience, try computer-fixing in the repair store or cereal-mixing in the health food store.

You'll receive plenty of on-the-job training in each shop. Some shops will have easy work. Other shops will give you more time-consuming tasks. In each shop, the challenge will increase as your skills improve.

Work in the *Math Shop* mall can be scheduled as you like. In the One Shop game, you can work as long as you like, serving as many customers as you please.

In the One Shop With Clock game, you work against the clock, from 9:00 to 5:00, serving as many customers as you can during a simulated shopping day.

When you've gained some experience in each of the shops, try the All Shops game. Customers will be waiting for your help in all 10 shops. You'll really have to keep moving! Serve as many customers as quickly as you can so that the lines don't get too long. With good work, you may even earn the honor of putting your name on the list of Top Employees. What a way to launch your career!

What's in This Package?

Along with this handbook, your *Math Shop* package includes the following components:

- The *Math Shop* program disk
- The Color Graphics disk
- Two Legal Copy labels

Equipment Needed

To use *Math Shop*, you need the following equipment:

- A Macintosh® Plus, SE, LC, Classic, or II computer
- System Software 6.0.2 or higher
- Two blank disks for making a Legal Copy of the program

NOTE: The Math Shop *package contains both black and white, and color graphics. If you are using the program on a monochrome Macintosh, you will only use the program disk. If you are using the program on a color Macintosh, you will use both the program disk and the Color Graphics disk. To use the color version, you must either have a hard disk or two high-density floppy drives. Using a hard disk, copy both the program disk and the Color Graphics disk onto it and run the program from there. Using two high-density floppy drives, copy both the program and the Color Graphics disk onto one high-density disk. Then run the program by inserting the system disk into one drive and the disk, containing the program and the color graphics, into the other drive.*

Making a Legal Copy of *Math Shop*

The disks included in the *Math Shop* package are Archival disks. Follow the instructions below for previewing the disks, or for making a Legal Copy once you have purchased the program.

For a complete description of your rights and responsibilities in copying disks and using the program, see the Scholastic Software License and Warranty Agreement included in this package. Scholastic also encourages you to read the Guide to Software Copyright Policies and Ethics on page 37.

The disks in this package are fully protected by copyright law. It is against the law to copy or in any way duplicate the disks or any portion of the program except under the terms expressly stated in these instructions and in the Scholastic Software License and Warranty Agreement.

Previewing *Math Shop*

You are invited to preview *Math Shop* for up to 30 days before you decide whether or not to purchase the program. To protect the Archival disks, please make a temporary Legal Copy of the program and use it to preview *Math Shop*. Please note that the Legal Copy labels should not be affixed to the temporary Legal Copy unless you decide to purchase the program, and the temporary Legal Copy must be erased at the end of the 30-day period if you decide not to purchase the program.

Once You Have Purchased *Math Shop*

Once you have purchased the *Math Shop* package, you must make a Legal Copy of the Archival disks. You may not use the Archival disks for running the program. Use the Legal Copy instead.

MAKING A LEGAL COPY WITH ONE DISK DRIVE

1. Insert your Macintosh system disk into the drive.
2. Turn on the computer. The system icon will appear.
3. Choose Eject from the FILE MENU, to eject the system disk.
4. Insert the *Math Shop* program disk. The disk icon will appear.
5. Choose Eject from the FILE MENU to eject the program disk.
6. Insert a blank, initialized disk. The disk icon will appear.

7. Drag the *Math Shop* disk icon over the blank disk icon. A dialog box will appear asking you if you are sure you want to replace the contents of the blank disk (in drive) with the contents of the *Math Shop* disk (not in drive).
8. Click OK. The copying process will start.
9. When the disk has been copied, eject the *Math Shop* disk by dragging it into the Trash.
10. Affix the Legal Copy label to the disk.
11. Store the Archival disk in a safe place with a copy of Software License and Warranty Agreement.
12. Repeat Steps 4–11 to make a Legal Copy of the Color Graphics disk.

MAKING A LEGAL COPY WITH TWO DISK DRIVES

1. Insert your Macintosh system disk into a drive.
2. Turn on the computer. The system disk icon will appear.
3. Choose Eject from the FILE MENU to eject the system disk.
4. Insert the *Math Shop* program disk in one drive and a blank initialized disk in the other drive. Disk icons for both disks will appear.
5. Drag the *Math Shop* program disk icon over the blank disk icon. A dialog box will appear asking you if you want to replace the contents of the blank disk with the disk contents of the *Math Shop* disk.
6. Click OK to start the copying process.
7. When the disk has been copied, eject both disks by dragging them, one by one, into the Trash.
8. Affix the Legal Copy label to the disk.

9. Store the Archival disk in a safe place with a copy of the Software License and Warranty Agreement.

10. Repeat Steps 4–9 to make a Legal Copy of the Color Graphics disk.

MAKING A LEGAL COPY ONTO A HARD DISK

You are permitted to install the *Math Shop* Archival disks on one hard disk. If you want to install the program on multiple hard disks, you must buy multiple copies of *Math Shop*. Follow the instructions below for copying the program onto a hard disk.

1. Turn on your computer (and your hard disk, if they are separate). Wait for the system to load into the computer.

2. Insert the *Math Shop* program disk into the floppy drive. The *Math Shop* disk icon will appear.

3. Drag the *Math Shop* disk icon onto the hard disk icon. If you get a dialog box saying that the disk must be copied into a folder, click OK.

4. Eject the Archival disk and store it in a safe place with a copy of the Software License and Warranty Agreement.

5. If you have a Macintosh with a color monitor, repeat Steps 2–4 to copy the Color Graphics disk onto your hard disk. Put the contents of the two disks in a folder on your hard disk.

DEFECTIVE DISKS

If the Legal Copy disk becomes damaged or defective, try recopying the program from the Archival disk to the Legal Copy disk. If the program still does not work, the Legal Copy disk may be defective. In this case, copy the program from the Archival disk onto another disk as a temporary Legal Copy. Then send the defective Legal Copy disk to Scholastic at the address below for a free replacement. When you receive the replacement, erase the temporary Legal Copy that you made.

If an Archival disk is damaged or defective, send it to Scholastic at the following address for a free replacement:

Scholastic Software
Scholastic Inc.
2391 E. McCarty St.
Jefferson City, MO 65102

In Canada:
Software from Scholastic
Richmond Hill, Ontario
Canada, L4C 3G5

In Australia:
Ashton Scholastic Software
P.O. Box 579
Gosford NSW 2250
Australia

Loading *Math Shop* From a Floppy Disk Drive

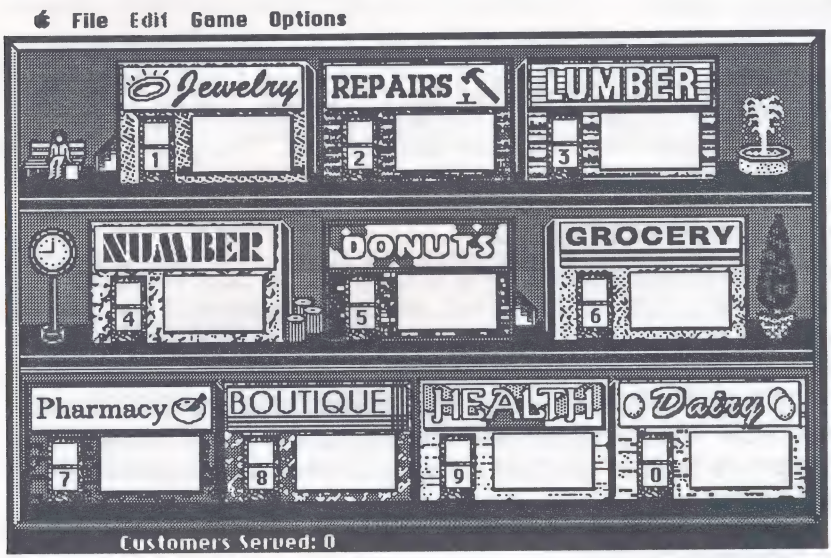
1. Insert your Macintosh system disk into the drive.
2. Turn on the computer. The system disk icon will appear.
3. If you have a single disk drive, choose Eject from the FILE MENU. Remove the system disk and insert the *Math Shop* program disk. If you have two drives, insert the *Math Shop* program disk in the second drive. The *Math Shop* disk icon will appear.
4. Double-click the *Math Shop* disk icon. The disk window will open.
5. Double-click the *Math Shop* program icon. The program will load.

Loading *Math Shop* From a Hard Disk

1. Turn on your computer and hard disk. Wait for the system to load into the computer.
2. Double-click the hard disk icon. The hard disk window will open.
3. Double-click the *Math Shop* program icon to load the program.

Getting to Work

When you have loaded the program, you will see the three-story *Math Shop* mall.



To begin work, click one of the storefronts. You will enter that store and begin your job. However, before starting the game, you might want to explore the options in the menu bar at the top of the screen. The following is a brief description of each menu.

APPLE MENU

ABOUT *MATH SHOP*...

Read About *Math Shop* to become familiar with the overall features of the program.

ABOUT COPYING....

About Copying explains Scholastic's policy on copying this software.

FILE MENU

QUIT ⌘Q

Choose Quit to leave the program and return to the desktop.

EDIT MENU

You cannot use the edit commands in *Math Shop*. Therefore, they are dimmed.

GAME MENU

ONE SHOP ⌘1

In this game, you can enter any store of your choice and serve customers at your own pace. The "Customers Served" number, which appears at the bottom of the screen, keeps track of the number of customers that have been served. The game ends when you return to the mall.

ONE SHOP WITH CLOCK ⌘2

This game is similar to the One Shop game, except that there is a clock at the bottom of the screen which keeps track of the time from 9:00 to 5:00. The idea is to serve as many customers as possible during a 9-to-5 shopping day. The actual time from 9:00 to 5:00 is approximately five to eight minutes. When 5:00 comes around, the shop automatically closes and the game is over. The "Customers Served" number shows you how many customers were served.

ALL SHOPS ⌘3

In the All Shops game, you serve as many customers as possible in all 10 shops. When the game starts, there are customers waiting to be served in many of the shops, and more customers keep arriving. When the 10th customer arrives in a shop, all the customers grow impatient and leave. The game ends when the "Customers Lost" number at the bottom of the mall screen shows that 50 customers have left the mall. The "Customers Served" number shows the total number of customers served in all the shops. When the game ends, this number is the final score.

If you do well in the All Shops game, you may earn the honor of placing your name on the list of famous *Math Shop* workers. For more information, turn to the Top Employees List section on page 17.

OPTIONS MENU

CAN'T USE COLOR IMAGES

This option will be dimmed if you have a Macintosh computer with a monochrome monitor, you have not installed the Color Graphics onto your hard disk, or your color Macintosh does not have enough available memory to run the program in color.

USE COLOR IMAGES ⌘I

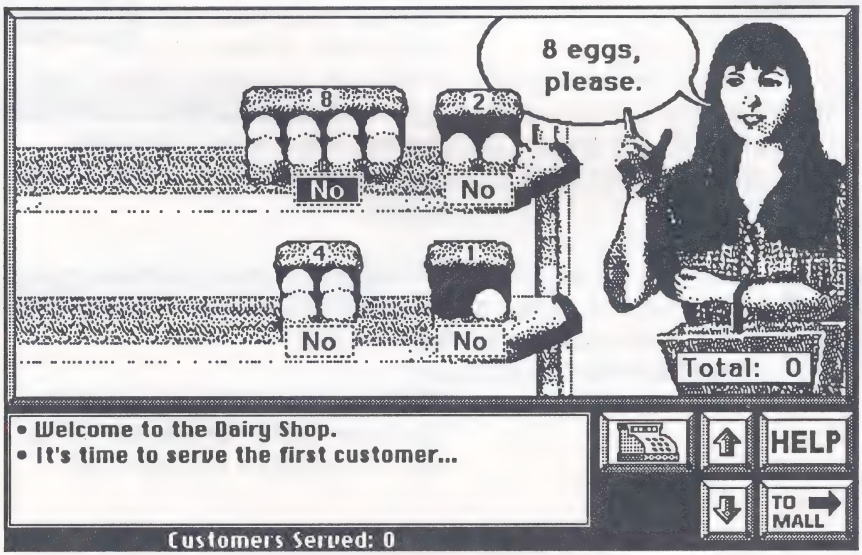
If you have a color Macintosh, you will see the Use Color Images option. This option toggles between color and black and white graphics.

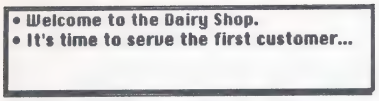
DON'T PLAY SOUNDS ⌘D

Choose Don't Play Sounds when you wish to play with no sound.

The Control Panel

Each shop has a control panel. You can use both the mouse and the keyboard to issue the control panel commands. (For a complete list of all keypresses in the program, see the Keys to Know section on page 19.)





Look in the message box for messages about each problem you are solving and about the arrival of new customers.

Click the Cash Register button to serve a customer.

When you play the One Shop With Clock game, the time will be displayed under the Cash Register button. You have from 9:00 to 5:00 to complete a work day. The actual playing time is from five to eight minutes.

When you are playing the All Shops game, you will see a Crowd sign under the Cash Register button. The Crowd sign will be dimmed when all stores in the mall have less than seven customers. When you are working in a store and the Crowd sign flashes and stays lit, it means that there is a crowd (at least seven customers) in one or more stores.

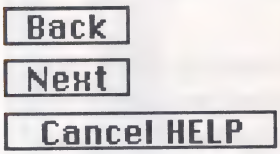
Click the Up Arrow button to increase the number in the active number box.

NOTE: In the dairy, you click the Up Arrow button to change No to Yes in the active number box.

Click the Down Arrow button to decrease the number in the active number box.

NOTE: In the dairy, you click the Down Arrow button to change Yes to No in the active number box.

Click Help to see instructions for a shop. The Help instructions appear in the message box.



Click the Back and Next buttons below the message box to browse through the instructions. Look for outlined items on the screen as you read through the instructions. When you are ready to play the game, click Cancel Help.

Click the To Mall button to go back to the mall.

This displays the number of customers you have served when you are playing the One Shop game or the One Shop With Clock game.

When you are playing the All Shops game, this shows the number of customers waiting in the shop you are working in.

Tips for Playing the All Shops Game

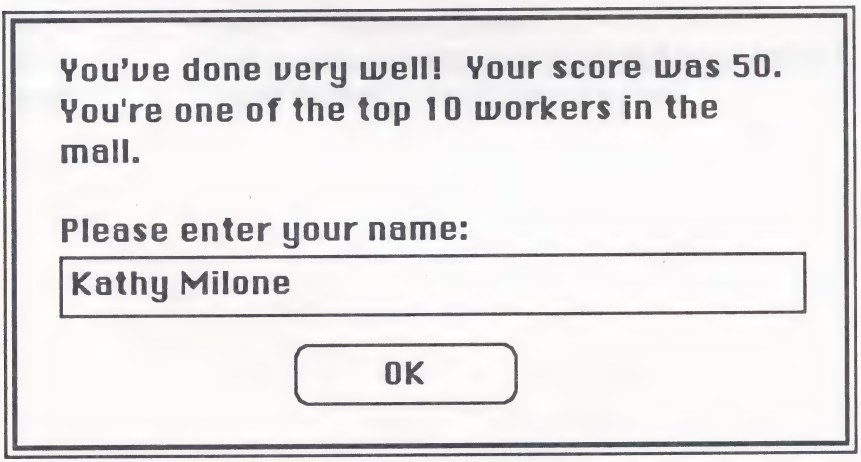
Here are some playing strategies for the All Shops game:

1. Head for the more crowded stores first. The more customers there are waiting in a line, the closer the store is to being overcrowded.
2. Serve at least a few of the customers at each shop, even if you think some shops are more difficult than others. Remember, at any shop, the first customers are the easiest ones to serve. Even if you serve only three customers, you will delay overcrowding. This will give you more time to help in the other, easier stores.
3. A store can never overcrowd while you're working there. You can let a store line build up to nine customers, and if you arrive there before the 10th customer, you can stay there and work without worrying that it will overcrowd while you're there.
4. As you play the All Shops game, write down the names of the stores that give you trouble. Then switch to the One Shop game, and choose each of those stores for practice. After a few practice sessions, try the All Shops game again. You should find that your score improves.
5. When a store in the mall has seven or more customers waiting, the crowd sign on the control panel will flash and light up. When the crowd sign is lit, a good strategy is to leave the store you are in and go to a more crowded one.

Top Employees List

Math Shop keeps track of its best employees and displays their names on the Top Employees list. To see this list, click the fountain in the mall. You can add your name to this list if your final score in an All Shops game beats a score on the list.

If your final score in an All Shops game qualifies for the Top Employees list, the following message will appear on the screen:



Enter your name and click OK. Your name and score will appear on the list.

If you want to save your name to the list, click the Save Scores button. Then click New Game to return to the mall.

*NOTE: To clear the Top Employees list and return it to the original list of famous mathematicians, press Option–Shift and click the ribbon, or press Option–Shift–**C**.*

Keys to Know

This section contains a complete list of the *Math Shop* keypress commands. Keep it beside your computer as a quick reference if you want to use the keyboard to issue commands.

In the Mall

PRESS	TO
1	Enter the jewelry shop.
2	Enter the repairs shop.
3	Enter the lumber shop.
4	Enter the number shop.
5	Enter the donut shop.
6	Enter the grocery.
7	Enter the pharmacy.
8	Enter the boutique.
9	Enter the health shop.
0	Enter the dairy.

Menu Bar

PRESS	TO
⌘–Q	Quit.
⌘–1	Play the One Shop game.
⌘–2	Play the One Shop With Clock game.
⌘–3	Play the All Shops game.
⌘–I	Toggle between color and black and white images.
⌘–D	Toggle between sound and no sound.

In the Shops

PRESS	TO
Return	Serve a customer.
↑	Add to the number in the active number box.
↓	Subtract from the number in the active number box.
H	Read instructions.
B	Go to previous Help card.
N	Go to next Help card.
C	Cancel Help.
T or **M**	Return to mall.
Tab or Space Bar	Move between number boxes.

List of Shops and Skills

SHOP	CONCEPTS AND SKILLS
Boutique	• Identifying values of coins • Subtracting decimals (with one or two regroupings) • Estimating sums and differences • Mentally adding and subtracting
Dairy	• Expressing base 10 numbers in base 2 system • Mentally adding and subtracting whole numbers
Donuts	• Finding fractional parts of a group of objects • Writing fractions in simplest form (lowest terms) • Mentally adding and subtracting • Applying the concepts of ratio and proportion

Grocery	• Practicing problem solving: exploring different ways to find a solution • Mentally adding and subtracting whole numbers • Estimating
Health	• Working with estimation • Applying the concept of ratio and proportion • Solving equations with two variables (systems of equations) • Practicing problem solving: examining answers for reasonableness
Jewelry	• Adding and subtracting decimals • Estimating sums and differences • Understanding decimal place value (tenths, hundredths, and thousandths)
Lumber	• Solving equations with two variables (systems of equations) • Adding and subtracting linear measures • Converting inches to feet • Practicing problem solving: examining answers for reasonableness
Number	• Applying knowledge of the following: digit, factor, multiple, remainder, even and odd numbers, greater than and less than • Practicing problem solving: using alternative strategies

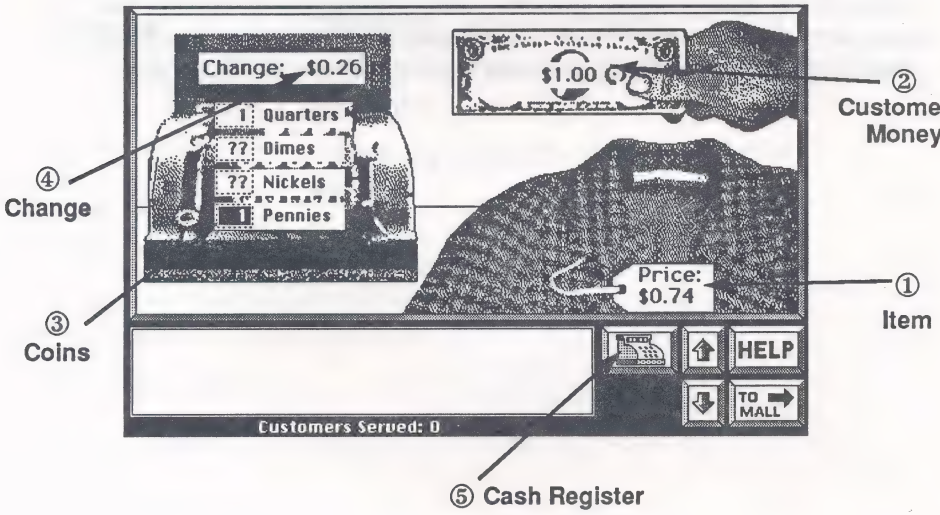
Pharmacy	• Finding a percent of a given number • Understanding the concept of 100 percent meaning a whole • Changing percents to fractions and decimals
Repairs	• Computing whole numbers • Finding values of functions for given input numbers • Practicing problem solving: looking for patterns

GUIDE TO THE SHOPS

This section contains one page of information for each of the *Math Shop* shops. This information includes illustrated instructions for working in the shop and a sample problem. The instructions assume that you are using the mouse to control the program. If you want to use the keyboard commands, you may want to refer to the Keys to Know section, on page 19, as well.

BOUTIQUE

Here at Manny's Bargain Boutique, you give the customers change for the clothes they buy. You have to use the fewest amount of coins possible.



① Here you'll see the price of the item that the customer is buying. This customer is buying a jacket that costs 74 cents.

② This customer hands you a $1 bill.

③ How much change should you give? You must use as few coins as possible. Highlight the number box next to the coin you want and enter the desired number. For this customer, 26 cents is the correct change. The fewest number of coins that add up to 26 cents are: 1 quarter and 1 penny.

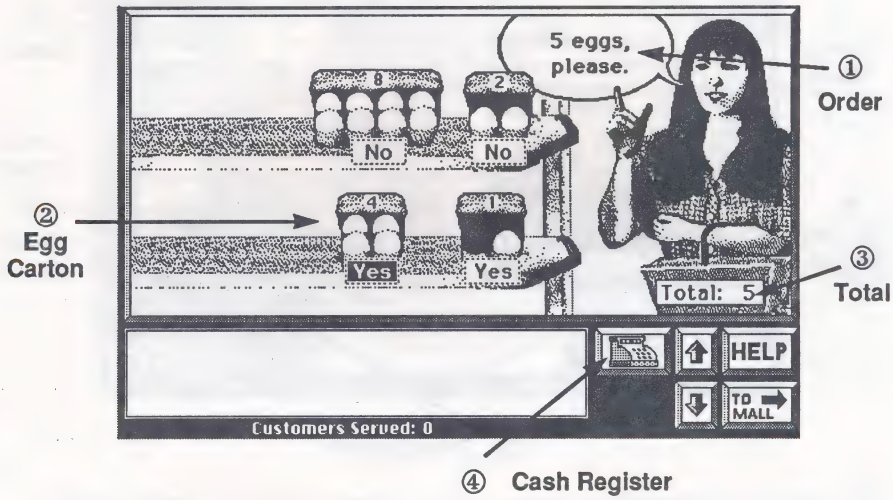
④ This shows the amount of change you are giving the customer. Here the total value of the coins is 26 cents.

⑤ When you have the correct change, click the Cash Register button to serve the customer.

When you have served a few customers, some big spenders with $5 and $10 bills will come into the boutique.

Dairy

Here at Eggland Dairy, your job is to sell eggs in cartons of different sizes. Customers tell you their egg orders. You choose the cartons to give each customer. You have to give the customer the exact number of eggs she wants.



① Each customer will tell you her order. This customer wants 5 eggs.

② Each egg carton has a label showing how many eggs it holds. This one holds 4 eggs. To choose a carton, click No below it and Yes will appear. If you change your mind, click Yes and No will appear. For this customer, the cartons holding 4 eggs and 1 egg have been chosen (4+1=5).

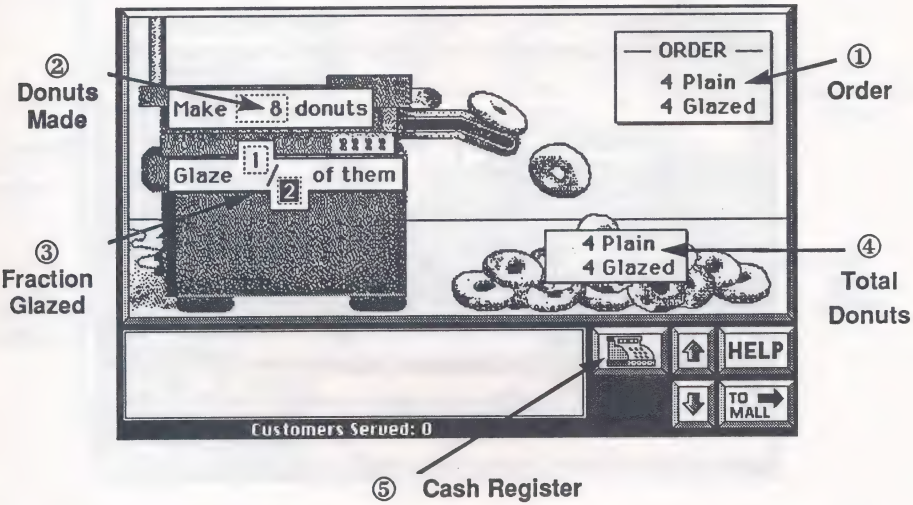
③ On the customer's basket, you will see the total number of eggs you have chosen. There are 5 eggs in the basket right now.

④ When the total on the basket matches the order, click the Cash Register button to serve the customer.

When you have served a few customers, you will have more carton sizes to choose from.

DONUTS

At Alice's Palace of Donuts, there is a snazzy new donut machine—a machine that bakes, glazes, and fills donuts. Your job is to adjust the donut machine so that it's properly set for each order.



① Here you'll see the order. This customer wants 4 plain and 4 glazed donuts.

② First you decide how many donuts the customer wants. Enter the number here. In this case, it is 8.

③ Then you need to set the machine to make the glazed donuts. The rest of the donuts will automatically be plain. To set the machine correctly, you figure out what fraction of the total amount of donuts should be glazed. For this customer, the machine has been set to glaze half (1/2) the donuts.

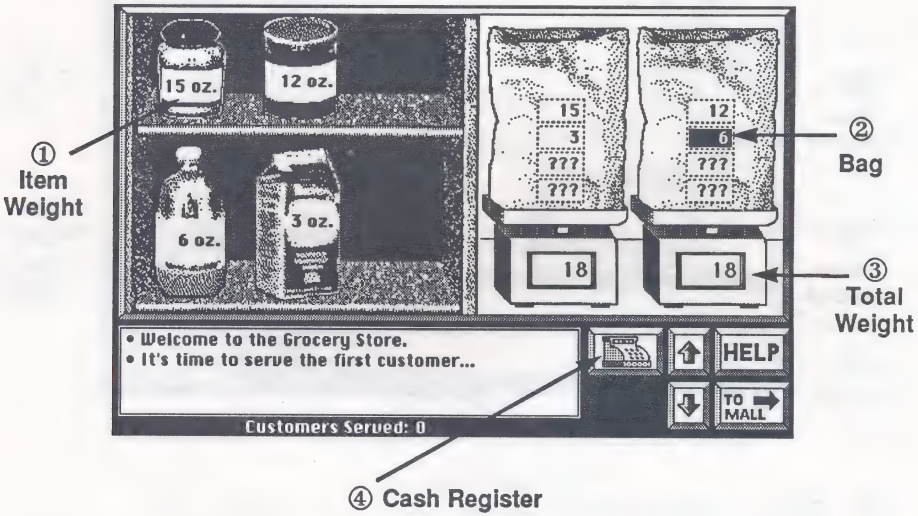
④ Here you see how many donuts you have made. In the example, there are 4 plain donuts and 4 glazed donuts. The machine settings are correct!

⑤ When the order is correct, click the Cash Register button to serve the customer.

When you have served a few customers, you will be ready to sell filled donuts along with the glazed and plain donuts!

GROCERY

At Karen's Groceries, you are hired to pack groceries. Since our customers insist on two perfectly balanced bundles, both bags must weigh the same.



① The weight of each grocery item is shown on the label. This item weighs 15 ounces.

② You must pack all four grocery items into the two bags. You may use each item only once. Click a number box on a bag and then click the label on a grocery item. The weight of the item will appear in the number box.

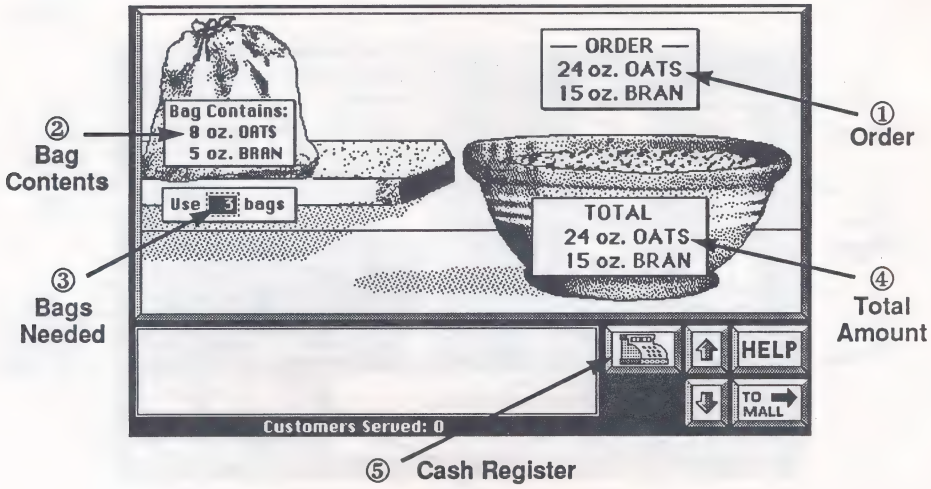
③ Look at the scales to see the total weight of the grocery items in the bags. Remember, you must pack all four items into the bags and both bags must weigh the same. These bags have been packed correctly. They both weigh 18 ounces.

④ When you have packed all items and both bags weigh the same, click the Cash Register button to serve the customer.

As you gain experience, you will have more grocery items to pack.

HEALTH

At Crunchee Health Foods, you are hired to custom blend cereal by selecting the right mixture of oats and bran for each customer.



① Each customer wants a custom blend of cereal. This customer wants a blend of 24 ounces of oats with 15 ounces of bran.

② Cereal comes in a pre-mixed bag. This bag contains 8 ounces oats and 5 ounces bran. How many bags do you need to fill the order?

③ Enter the number of bags here. In this case, you need 3 bags.

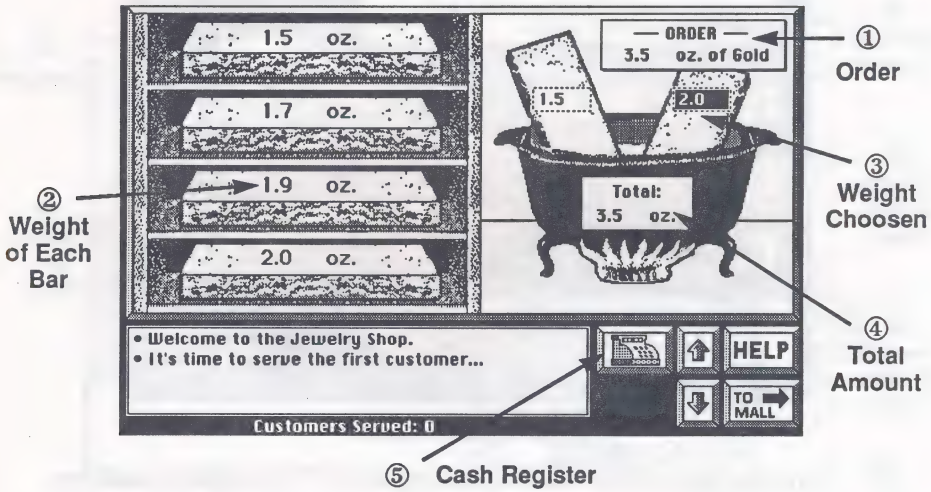
④ The total on the bowl shows you how much cereal you have selected. Now there are 24 ounces of oats and 15 ounces of bran in the bowl. That's exactly the amount the customer requested.

⑤ When the amount in the bowl is the same as the order, click the Cash Register button to serve the customer.

When you have served a few customers, you will have two brands of cereal to mix.

Jewelry

At the Heart of Gold Jeweler, every ounce counts! You sell gold in tenths, hundredths, and thousandths of ounces. You choose two gold bars that melt down to the exact amount of gold the customer needs.



① Each customer will tell you his order. This customer wants 3.5 ounces of gold.

② The weight of each gold bar is stamped on its side. Which two of these gold bars will weigh 3.5 ounces when melted together?

③ You enter the weight of the two gold bars you choose here. Click a number box on a melting gold bar and then click the weight of one of the gold bars on the shelves. The weight will appear in the number box. In this case, the 1.5-ounce bar and the 2.0-ounce bar are the correct choices.

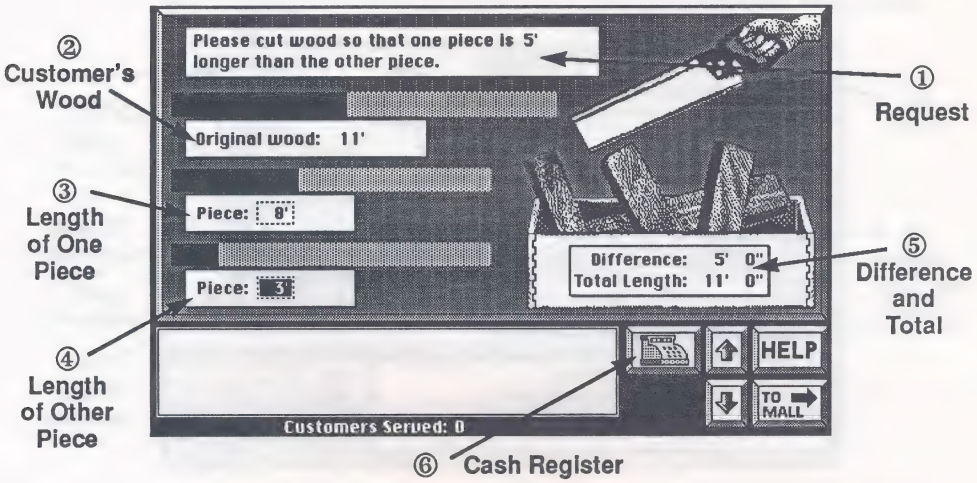
④ Look here to see the total number of ounces in the pot. Now there are 3.5 ounces—exactly what the customer ordered.

⑤ To serve the customer, click the Cash Register button.

Later, the weights change as customers ask for more precise amounts of gold.

LUMBER

At the World of Lumber, your task is to cut wooden boards into two pieces. Customers will tell you how much longer one piece should be than the other piece. Be sure to measure carefully!



① Here you'll see the customer's request. This customer wants the board cut so that one piece of wood is 5 feet longer than the other.

② This is the customer's original piece of wood. In this case, it is 11 feet long. How would you cut this piece in two?

③ Enter the length of one piece here. In this example, the piece is 8 feet long.

④ Enter the length of the other piece here. This one is 3 feet long.

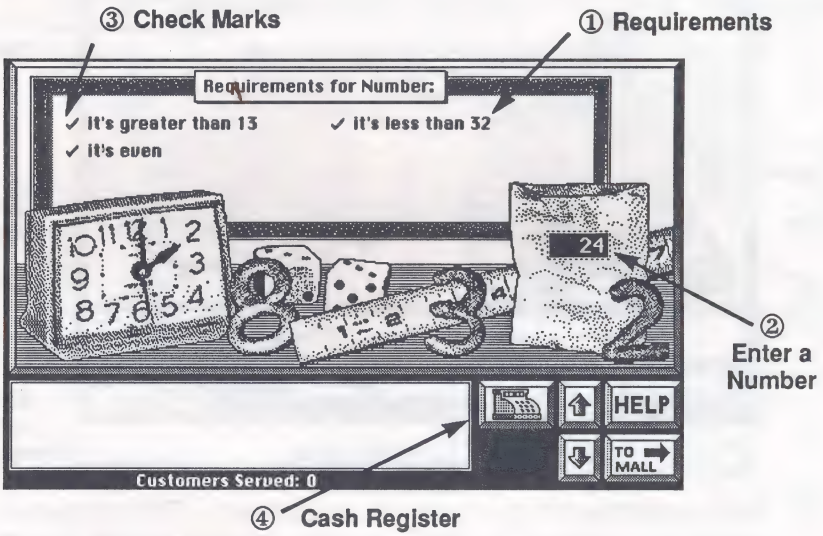
⑤ Here you see the difference between the two pieces and their total length. We cut this piece correctly! The difference is 5 feet and the total length is 11 feet.

⑥ When the difference on the storage box matches the order and the total length matches the original wood, click the Cash Register button to serve your customer.

After sawing a few pieces of wood, you'll be ready to saw pieces in feet and inches.

NUMBER

The customers at Number Unlimited need you to help them find a number. Customers come into the number shop with a list of requirements. You must examine the list and come up with a number that fits all the requirements.



① Each customer will give you a list of requirements. This customer wants a number that is greater than 13, even, and less than 32.

② When you think of a number that fits, enter it here. Sometimes more than one number is correct. Here we've chosen 24.

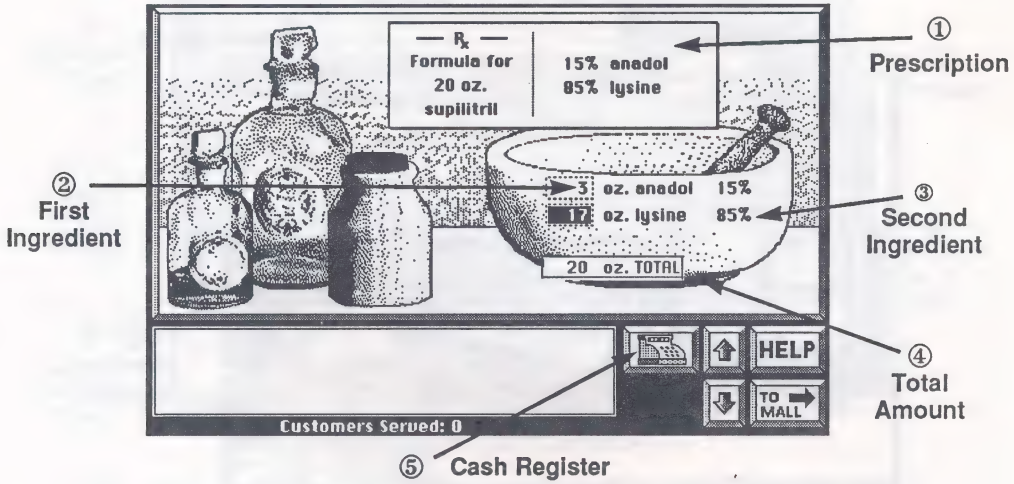
③ When a requirement has been met, a check mark will appear next to it. For this example, 24 is correct since all requirements are checked off.

④ When you have the correct number, click the Cash Register button to serve the customer.

As you become more experienced, you will get customers with lists of up to five requirements.

Pharmacy

As the pharmacist's assistant, your job is to mix the customers' medicine prescriptions. The pharmacist gives you a formula for each prescription. You must figure out how many ounces of each ingredient should be mixed to fill the prescription.



① Each customer will give you his prescription. This customer wants 20 ounces of supilitril, and the pharmacist tells you that the correct mix is made with 15 percent anadol and 85 percent lysine.

② In the mixing bowl, enter the number of ounces of anadol needed. In this case, it is 3 ounces. When you enter a number, notice that the percentage is automatically filled in.

③ Next enter the number of ounces of lysine needed. Here it is 17 ounces. Now look at the percentages. Do they match the percentages given in the formula?

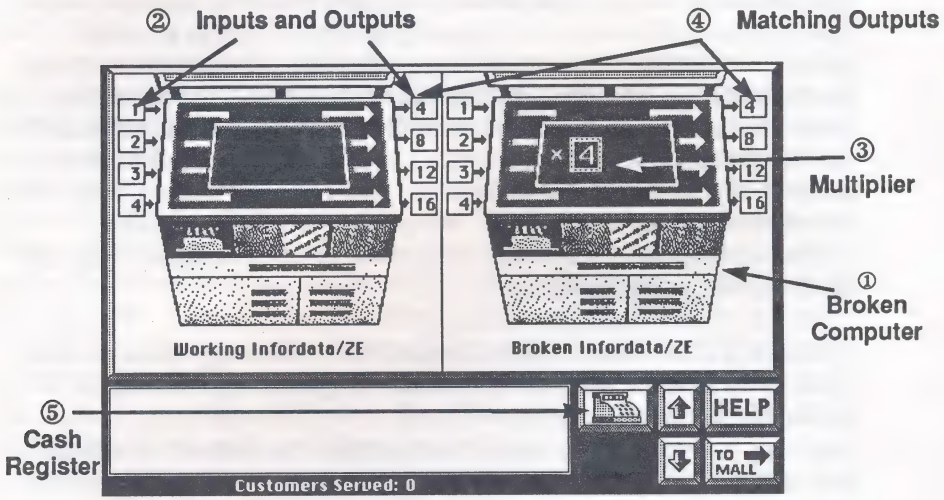
④ Here you see the total amount of mixture in the bowl. Now there are 20 ounces in there.

⑤ When the total ounces and the percentages match the prescription, click the Cash Register button to serve your customer.

When you have mixed a few prescriptions, you are ready to mix medicines with three and four ingredients.

REPAIRS

At the All Fixin's Repair Shop, there are many broken computers that need to be fixed. As the number cruncher, you must study the working computer on the left to figure out what is missing from the broken computer on the right.



① Each customer has a broken computer that needs to work like the one you have in the store. This customer is bringing in an Infordata/ZE for repair.

② The working Infordata/ZE has inputs of 1, 2, 3, and 4 and outputs of 4, 8, 12, and 16.

③ To fix the broken computer, you must determine the multiplier needed to produce outputs that match those on the working computer. Enter the correct number here. In this case, the multiplier is 4.

④ Notice that the outputs on the broken computer now match the outputs on the working computer.

⑤ When the outputs on the two computers match, click the Cash Register button to serve the customer.

After several repairs, the computers are harder to fix. You'll need to work with multipliers and addends.

Why *Math Shop*?

by Cary Hammer

Mathematics is a subject about which most elementary and high school students tend to have strong feelings. In the average school, a small percentage of students have a fascination as well as a seemingly effortless facility with the workings of numbers. Conversely, a great proportion confess complete bafflement with the very notion of math, and thus a total lack of interest in the subject. What is striking is how few students fall somewhere between these two extremes. Why is it that mathematics, perhaps more than any other academic field of study, is such an all-or-nothing proposition?

Perhaps a clue is to be found in children's differing views of what math is all about. Some see it as an elegantly logical and endlessly fascinating game. Others consider math to be an arbitrary and restrictive set of rules, under the domain of which any given task is a tedious and meaningless chore. While these two views are perhaps equally valid, it is clear that the child who sees the game buried beneath the numbers is likely to dig more deeply into them. A child who views a learning experience as fun and relevant is more likely to develop a positive attitude toward the subject. But it is in the field of mathematics that this viewpoint seems to vary to the greatest degree.

Mathematical attitude affects mathematical aptitude. The educational problem is one of determining how best to encourage the proper frame of mind. In mathematics, the extent to which a child views a given exercise as entertaining is largely dependent on the ease with which he or she can perform the low-level number manipulations involved. The child who must agonize over the basic arithmetic operations necessary in tackling a complex rate-time-distance problem is much less likely to appreciate the final elegance of its solution. However, the child for whom the processes of addition and subtraction are more automatic tends to focus the bulk of his or her attention on the more interesting problem-solving aspects of the task.

In considering these sorts of learning situations, the difference between computers and pencils becomes particularly clear. Unlike a pencil, a computer can automatically handle the more tedious elements of a math problem, freeing a child to concentrate on the higher-level logic involved. Thus, it is this approach of decreasing the distractions along the way to effective mathematical problem solving that I have used as the focus of *Math Shop*.

Math Shop is a vehicle for honing arithmetic skills, in addition to developing problem-solving techniques. However, enough of the burden of arithmetic computation has been shifted to the machine to allow children to more easily see the overall dynamics of each type of problem. Due to the spreadsheet-like structure of *Math Shop*, when a child enters a possible answer to a given problem, he or she immediately sees how this value affects every aspect of the problem. Just as an executive, using a spreadsheet program to rework a financial plan, can see how a lowered production cost would affect all segments of the budget, the child is given a broad vantage point on the problem. Thus, the child is never merely told that he is wrong; instead he or she is allowed to observe, to his or her own satisfaction, exactly why a given answer doesn't work.

In addition, the problems posed by *Math Shop* are framed in a visual, rather than verbal, context. Each challenge is presented in the form of a graphic screen depicting the real-world setting of the problem, such as a pharmacy or a grocery store. This allows the child to more easily perceive the structure of the task, and encourages a specific organizational method for its solution.

Perhaps the most apparent dimension of *Math Shop* is the gamelike framework which offers an incentive for problem solving. This type of structure is an ideal context in which to present math problems, as the average child needs little coaxing to try a new game. However, *Math Shop* is not the typical computer game in which the child pilots a colorful flying saucer through the galaxy while shooting down equally-colorful enemy creatures, occasionally earning more fuel by correctly solving algebraic equations.

This method promotes the sort of "do your work and you'll get some candy" approach that immediately cues the child that the task at hand is so inherently dull that it requires an artificial reward. The child's attention and interest consequently are focused toward flying saucers and away from the numbers.

The design strategy underlying *Math Shop* takes a different tack. Rather than creating an entertaining game, and then searching for holes into which math problems can be force-fit, I think it is better to work in the opposite direction. By beginning with the mathematical concepts, and working from the logical challenges which make them intriguing and gamelike in and of themselves, I have tried to build an overall game structure which is integrative with, rather than distracting from, the primary concepts. I hope *Math Shop* will demonstrate that, given free rein to show off, and the proper stage on which to perform, mathematics can be entertaining enough in itself without being dressed up in silly costumes.

Mathematics is a science of finding that which is not completely hidden; that which is only obscured by complexity. Sadly, the entertaining nature of mathematics itself can be one of its most darkly obscured truths. Hopefully, *Math Shop*, by presenting mathematics in a different light, will help children to uncover this all-too-well-kept secret.

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